Annexure – I

Syllabus for B.Tech. III Semester

B.Tech – Mechanical Engineering

Sr. No.	Course Code	Courses	Scheme L	T	P	Credits
1	ME3CO01	Production Processes	3	0	0	3
2	ME3CO02	Strength of Materials	3	1	2	5
3	ME3CO03	Theory of Machines	3	1	2	5
4	ME3CO04	Engineering Thermodynamics	3	1	0	4
5	ME3CO05	Auto CAD Lab	0	0	2	1
6	ME3CO06	Fluid Mechanics	3	1	2	5
7	ME3ES09	Engineering Materials	3	0	0	3
		Total	**18**	**4**	**8**	26
		Total Contact Hours	30			

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3CO01	Production Processes	3	0	0	3

UNIT-I MOULDING:
Cores, Core Prints, Core boxes, Pattern design, Pattern layout and construction, testing of moulding sand. moulding and core making machines, use of chaplets, CO2 - Process, fluid sand process, shell moulding, cold curing process, hot-box method, high pressure and flask less moulding, Design of metal moulds, Die Design for die Casting.

UNIT II CASTING:
Directional principles, Solidification, types of gating systems, Pouring time and temperature. Design criteria of pouring basin, screw, runner, gate and riser, gating ratio, chill and its uses. Selection of melting furnaces, Crucible furnaces, Electric furnaces, Induction furnace, Control of melt and Cupola charge calculations. Foundry mechanization and lay out. Casting defects, Causes and remedies.

UNIT-III FORGING:
Classification of forging processes - forging processes - forging defects and inspection. Rolling: Classification of rolling processes - rolling mill - rolling of bars and shapes. Extrusion: Classification of extrusion processes - extrusion equipments - examples.
Extrusion: Drawing of rods, wires and tubes.
Sheet Metal Working : Sheet metal forming methods: Shearing, Blanking, Bending, Stretch Forming, deep forming. Spinning: Spinning processes.

UNIT-IV WELDING:
Principle, classification, advantages, limitations and applications, Tungsten Inert Gas welding, Metal Inert Gas welding, Electro - slag welding, Electro - Gas Welding, Explosive Welding, Ultrasonic Welding, Electron Bean Welding, Laser Beam Welding, Friction Welding, Cold Welding, Thermit Welding, Codification of Electrodes, Welding Defects-causes and remedies.

UNIT- V POWDER METALLURGY:
Definition, advantages, limitations and applications, Powder metallurgy processes and operations, Compaction – Sintering and Finishing – Design considerations for powder metallurgy and Process capability – Shaping of ceramics –Forming and shaping of glass – Design considerations for ceramics and glass – Processing of superconductors.

TEXT BOOKS:
1. Rao P.N., "Manufacturing Technology", Vol. 1, Tata McGraw Hill.
2. Sharma P.C., "A Text Book of Production Engineering", Vol.1, S. Chand Publication, New Delhi.
3. Jain R.K., Production Technology, Khanna Publishers.
4. Hajra Choudhry, Elements of Workshop Technology, Vol I & II Media Promoters & Publishers.

REFERENCE BOOKS:

1. Production Technology by HMT, Tata McGraw-Hill.
2. Chapman, W.A.J., Workshop Technology, Vol - II, Oxford & IBH Publishing Co. Ltd.
3. Lindberg R.A., "Processes & Materials of Manufacture", Prentice Hall Publication.
4. R.B. Gupta, "Production Technology", Satya Prakashan.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3CO02	Strength of Materials	3	1	2	5

UNIT-I INTRODUCTION:
Stress and strain; normal, shear and bearing stresses; normal and shear strain, modulus of Elasticity, Poisson's ratio, Elastic and Bulk modulus, relation between elastic constants, deformation of axial members, tensile tests for ductile and brittle materials, yield strength, yield criteria, ultimate strength, factor of safety, mechanical properties, temperature stresses in simple and composite members.

UNIT-II COMPOUND STRESS AND STRAINS:
Strain energy due to axially applied loads (gradual, sudden and impact loads).State of stress, Generalized Hook's Law, stress transformation, principal planes, principal stresses and strains, maximum shear stress, Mohr's Circle representation for stress and strains.

UNIT-III STRESSES IN BEAMS:
Pure bending, bending of beams with symmetric cross section, composite cross sections, shear stress in beams, deflection in beams by different methods for various boundary conditions. Shear Force and Bending Moment Diagrams **Deflection of Beams**; Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method.

UNIT-IV TORSION OF SHAFTS:
Torsional Moment Diagram, torsion formula for solid and hollow shafts, maximum normal and shear stress, angle of twist, combined effect of axial load, bending moment and torsional moment on circular shafts.

UNIT-V COLUMNS AND STRUTS:
Buckling and stability, slenderness ratio. Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipment's and machines.

TEXT BOOKS:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of Materials by.Beer, Jhonston, DEwolf and Mazurek, TMH
3. Mechanics of Materials by James M Gere & Barry J Goodnoo cengage learning
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Gere and Goodno.

REFERENCE BOOKS:

1. Timoshenko, S.P., Gere, M.J., Mechanics of Materials, C.B.S., Publishers.
2. Ramamurtham, S., Strength of Materials,, Dhanpat Rai Publications.
3. Popov, E.P., Engineering Mechanics of Solids, Prentice-Hall.

LIST OF PRACTICAL:

1. To determine the Brinell Hardness Number of CI, MS, Al and Brass specimen.
2. To determine the Rockwell Hardness Number of CI, MS, Al and Brass specimen.
3. To determine the Vicker's Hardness Number of CI, MS, Al and Brass specimen.
4. Study of Universal Testing Machine and to carry out tensile test, compression test.
5. To determine Impact strength of given specimen by Charpy and Izod test.
6. To study of Impact testing of PVC pipes by falling dart method.
7. To compare observed & theoretical values of Deflection of Simply supported Beam.
8. To verify the slope & deflection of beam using moment area method.
9. To find the value of flexural rigidity for a given beam & compare it with theoretical value.
10. To find bending moment as a beam apparatus & compare with theoretical value.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
ME3CO03	Theory of Machines	3	1	2	5

UNIT I MECHANISMS AND MACHINES

Rigid and resistant body, Definitions and classification of Links, Kinematic pairs, Chains and Mechanism, Difference between mechanism and machine., Degrees of freedom : for a pair and mechanism, Gruebler's & Kutzback's Criterion for planer mechanisms, Inconsistencies in Gruebler's criteria, Equivalent linkages, Kinematic inversion, Different Inversions of Four bar chain, Slider crank chain and Double slider-crank chain. Number Synthesis of mechanism, **Different lower paired mechanisms**: Kinematic analyses of- Straight line mechanisms : Approximate and Exact Mechanisms, Davi's and Ackermann Steering Mechanisms, Hooke's Joint- Single and Double type , Pantograph Mechanisms, Quick Return Mechanisms- Slotted Lever and Whitworth's type.

UNIT II VELOCITY AND ACCELERATION ANALYSIS IN MECHANISMS

Concepts of planer motion of body as a point and as a rigid body, Displacement of a rigid body - Combination of rotation and translation, Relative displacement of two points on a rigid body, Pure rotation of a rigid body- Angular velocity of link , **Kinematic Analysis of Mechanisms : Graphical Methods of Velocity Analysis of Planer Mechanisms**: Relative Velocity Method- Velocity Diagrams of Mechanisms upto six links, Instantaneous Centre of Rotation Method : Properties of instantaneous centers, Aronhold- Kennedy Theorem of three centers, Velocity determination in mechanisms upto six links, **Acceleration Analysis of Planer Mechanisms:** Concepts of Radial and Tangential acceleration, Coriolis Component of acceleration, Acceleration Diagrams of different mechanisms. Klein's Construction for velocity and acceleration of Slider Crank mechanism.

UNIT III CAMS AND FOLLOWERS

Classification of Cams and Followers, Terminologies of Cams, Displacement, velocity and accelerations of followers for standard motions – Uniform motion, Parabolic, SHM and Cycloidal. Cam profile generation, Analysis for cams with specific contours, circular arc and tangent cams.

UNIT IV GEARS AND GEAR TRAINS

Classification of gears , Law of gearing, Spur Gears : Terminology, Velocity of sliding, Tooth profiles- Cycloidal and Involute and their comparison, Concept of path of contact, arc of contact and contact ratio and their relationship for spur gear pair, Concepts of Interference and Undercutting, Minimum number of teeth to avoid interference between – Gear and Pinion and between Rack and Pinion, Terminologies of Helical, Spiral, Worm and Worm gear and Bevel gears. **Gear Trains:** Spur Geared trains : Simple, Compound, Reverted and Epi-Cyclic - Velocity ratio and Torque calculations in gear trains, Introduction to Automobile Differential Gear Box.

UNIT V : GYROSCOPE

Concepts of Gyro-couple and Gyro-reaction Couples. Evaluation of gyroscopic couple. Evaluation of gyro-reaction couples and their effects in different machines – Boat,

Aeroplane, Two wheeler and Four wheeler. Stabilization of naval ship using Gyroscopic effect.

TEXT BOOKS :

1. Rattan S.S.; Theory of machines; Mc-Graw Hills Publications.
2. Ambekar A.G.; Mechanism and Machine Theory; PHI. Eastern Economy Edition.
3. Rao, J.S., and Dukkipati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.
4. Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi
5. Khurmi R.S. and Gupta J K, Theory of Machines, S.Chand & Co.
6. Bansal R.K., Theory of Mechines
7. Sharma & Purohit, Theory of Machines

REFERENCES BOOKS:

1. Bevan T., "Theory of Machines: A text book for engineering students", CBS, New Delhi.
2. Shigley, J.E. and Uicker, J.J. and Pennock, G. R.. "Theory of Machines and Mechanisms", Oxford University Press.
3. Ghosh, A, and Malick, A. K. "Theory of Mechanisms and Machines", East West Press Pvt. Ltd.

LIST OF PRACTICALS

1. To determine the degree of freedom of different kinematic pairs
2. To verify the principle of Pantograph apparatus.
3. To verify the principle of Watt's and Peaucellier's Straight line mechanisms.
4. To determine the cutting ratios in Whitworth and Slider Lever Quick Return Mechanisms
5. To verify the torques due to Coriolis component of acceleration.
6. To draw the cam profile of a given cam.
7. To study different types of gears.
8. To verify the velocity ratio and the holding torque in an epi-cyclic gear train.
9. To verify the applied gyroscopic couple using motorized gyroscopic apparatus.

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3CO04	Engineering Thermodynamics	3	1	0	4

UNIT-I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS:
Basic concepts, system, state, boundary, surroundings, path and point functions, process, equilibrium, polytropic processes, heat and work transfer, work as a function of p and v; pdv work for various processes, Heat transfer for various processes, concept of internal energy, first law of thermodynamics for a process and for a cycle, enthalpy, first law for steady flow, limitations of first law, PMM1.

UNIT II SECOND LAW OF THERMODYNAMICS:
Statements of second law, PMM2, reservoirs, Heat engines, refrigerator, heat pump, calculation of efficiency and COP, reversibility and irreversibility, Clausius inequality, Carnot cycle, Carnot's theorem, Entropy, T-s diagram, calculation of entropy for various processes, simple vapor compression refrigeration cycle.

UNIT-III STEAM PROPERTIES:
Pure Substances, phase transformation, formation of steam, its representation on T-Q, T-v, p-v, p-h, h-s, T-s charts, processes involved in phase transformation of water to superheated steam, dryness fraction, use of steam tables and Mollier chart, Separating calorimeter, Throttling calorimeter, combined separating and throttling calorimeter.

UNIT-IV AIR STANDARD CYCLES:
Overview of Stirling, Ericsson, Atkinson, Lenoir cycles, Otto (SI), Diesel (CI), Dual, Brayton cycles,, calculation of efficiency for each cycle and its comparison with Carnot efficiency, Comparison of Otto, Diesel and Dual efficiency for various working conditions.

UNIT- V MIXTURE OF GASES:
Properties of mixture of ideal gases, internal energy, Enthalpy and specific heat of gas mixtures, Entropy of gas mixtures, thermodynamic relations, Maxwell relations.

TEXT BOOKS:
1. P.K.Nag; Engineering Thermodynamics; TMH
2. Van GJ; Thermodynamics; John Wylen
3. Cengel Y; Thermodynamics; TMH
4. Arora CP; Thermodynamics; TMH
5. Thermal Engg. By R.Yadav

REFERENCE BOOKS:
1. Omkar Singh, Engineering Thermodynamics, New Age International.
2. Ratha Krishanan, Engineering Thermodynamics, PHI India Pvt. Ltd.
3. M. Achuthan, Engineering Thermodynamics, PHI India.
4. David R. Gaskell, Introduction to Thermodynamics of Materials, Taylor and Francis Publisher.
5. M. Achuthan, Engineering Thermodynamics, Prentice Hall India Limited.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3CO05	AutoCAD Lab	0	0	2	1

LIST OF PRACTICALS

1. Getting familiar with the Auto CAD Environment. Toolbars, working area, sub menus, working modes. Starting with some basic commands.
2. Study addressing schemes with different commands.
3. Studying basic objects and their commands e.g. circle, donut rectangle, arc, ellipse, polygon.
4. Studying commands that duplicate objects e.g. array, offset and modify commands e.g. trim, break, chamfer, fillet.
5. Studying Mirror, hatch, ltype, adding toolbars and object snap, zoom, text.
6. Making Isometric objects with isometric settings.
7. Applying dimensions (Aligned, Radius, Diameter, Angular, Leaders). Increasing / Decreasing working area, changing measuring scales.
8. Changing properties of dimensions through style. Modifying properties of objects. Changing dimensions using stretch and extend.
9. Studying setting of AutoCAD environment and Layers. Raster Images and External Reference Files.
10. Working on 4 view ports.
11. Changing views for 3d drawings, studying Solids and 3d objects box, sphere, cylinder, cone, wedge, torus, extrude, revolve.
12. Converting basic shapes example circle, rectangle, polygon, ellipse to solids using extrude command. Applying revolve command on polyline.
13. Subtracting solids and extruded objects. Studying 3d command.
14. Working with AutoCAD Views, 3D orbit, continuous orbit.
15. Generating finished objects by render.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3CO06	Fluid Mechanics	3	1	2	5

UNIT-I FLUID PROPERTIES AND HYDROSTATICS:
Density – Viscosity – Surface tension – compressibility – capillarity – Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.

UNIT-II KINEMATICS OF FLOW:
Types of flow-ideal & real , steady & unsteady, uniform & nonuniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow netstheir utility & method of drawing flow nets.

UNIT-III DYNAMICS OF FLOW:
Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

UNIT-IV DIMENSIONAL ANALYSIS AND DYNAMIC SIMILITUDE:
Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.)

UNIT-V LAMINAR FLOW:
Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles. Flow through pipes , Boundary Layer

TEXT BOOKS:

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; TMH
3. Som and Biswas; Fluid Mechnics and machinery; TMH
4. Cengal; Fluid Mechanics; TMH

REFERENCE BOOKS:

1. White ; Fluid Mechanics ; TMH
2. Gupta; Fluid Mechanics; Pearson
3. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
4. R Mohanty; Fluid Mechanics; PHI.

LIST OF PRACTICAL:

1. To determine the local point pressure with the help of pitot tube.
2. To Study terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Nozzle meter and Mouth Piece
6. Reynolds experiment for demonstration of stream lines & turbulent flow
7. Determination of meta-centric height
8. Determination of Friction Factor of a pipe
9. Verification of Impulse momentum principle.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
ME3ES09	Engineering Materials	3	0	0	3

UNIT I STRUCTURES:

Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Imperfections in crystalline solids and their role in influencing various properties.

UNIT II MATERIAL BEHAVIOR &MECHANICAL PROPERTIES:

Elasticity in metals, Mechanism of plastic deformation, strengthening mechanisms, Stress-strain diagrams of metallic, ceramic and polymeric materials. Ductile to brittle transition, creep failure mechanism, Fatigue mechanism. Mechanical properties, testing of materials under tension, compression and shear loads, Hardness tests & Impact tests.

UNIT III PHASE DIAGRAMS & HEAT TREATMENT:

Introduction - Solid solutions, Phase rules , Free energy in intermediate phases , Phase diagrams - Binary phase diagrams; iron-iron carbide metastable diagram, development of micro-structures in iron-carbon alloys. Isothermal transformation diagrams, TTT curves, various heat treatment processes.

UNIT IV METALLIC MATERIALS:

Stainless and tool steels, HSLA, Maraging steels, TRIP steel – Cast Irons, Copper and copper alloys, Aluminum and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT V NONMETALLIC MATERIALS:

polymeric materials - Formation of polymer structure – production techniques of fibre, foams, adhesives and coating - structure and properties and applications of engineering polymers - Advanced structure ceramics, WC, TiC, Al_2O_3, SiC, Si_2N_4, CBN and Diamond - Properties, processing and applications. Composite materials: Types, production techniques, structure, properties and applications.

TEXT BOOKS:

1. Raghavan V; Material Science and Engineering, PHI Publication.
2. Narula - Material Science, TMH
3. W.D. Callister, Jr., Materials Science and Engineering: An Introduction, Wiley & Sons
4. Krishnan K. Chawla, Composite materials, Science and Engineering Springer.

REFERENCE BOOKS:

1. J.C. Anderson, K.D. Leaver, P. Leavers and R.D. Rawlings, (2003), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers.
2. William F. Smith and Javad Hashemi (2004), Foundations of Materials Science and Engineering 4th ed., Mc Graw Hill.

3. Sidney H Avner, (2005) "Introduction to Physical Metallurgy, Tata McGraw Hill Publishing Company Limited
4. Lawrence E.Murr (2000), Failure analysis, Marcel Dekker Inc. Publications.
5. Askeland; The science and engineering of material, Cengage learning.